

# Swift Observations of GRB 130131B

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## 1. Introduction

At 19:10:08 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 130131B (trigger=547420) (Siegel *et al.* GCN Circ. 14159). Swift slewed immediately to the burst. **Table 1** contains the best reported positions from Swift, and the latest XRT position can be viewed at [http://www.swift.ac.uk/xrt\\_positions](http://www.swift.ac.uk/xrt_positions).

**Table 2** is a summary of GCN Circulars about this GRB from observatories other than Swift.

Standard analysis products for this burst are available at [http://gcn.gsfc.nasa.gov/swift\\_gnd\\_ana.html](http://gcn.gsfc.nasa.gov/swift_gnd_ana.html).

## 2. BAT Observations and Analysis

As reported by Sakamoto *et al.* (GCN Circ. 14164), the BAT ground-calculated position is RA, Dec = 173.957, 15.033 deg which is RA(J2000) = 11h 35m 49.6s Dec(J2000) = +15d 01' 59.3" with an uncertainty of 1.7 arcmin, (radius, sys+stat, 90% containment). The partial coding was 51%.

The mask-weighted light curve (**Figure 1**) shows a single pulse starting at  $\sim T-1$  s, peaking at  $\sim T+0.5$  s, and ending at  $\sim T+10$  s.  $T_{90}(15-350 \text{ keV})$  is  $4.30 \pm 0.26$  s (estimated error including systematics).

The time-averaged spectrum from T-0.28 to T+4.37 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $1.15 \pm 0.20$ . The fluence in the 15-150 keV band is  $3.4 \pm 0.4 \times 10^{-7} \text{ erg cm}^{-2}$ . The 1-s peak photon flux measured from T-0.28 s in the 15-150 keV band is  $1.0 \pm 0.2 \text{ ph cm}^{-2} \text{ s}^{-1}$ . All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at [http://gcn.gsfc.nasa.gov/notices\\_s/547420/BA/](http://gcn.gsfc.nasa.gov/notices_s/547420/BA/).

## 3. XRT Observations and Analysis

Analysis of the initial XRT data was reported by Stroh *et al.* (GCN Circ. 14176). We have analysed 5.3 ks of XRT data for GRB 130131B, from 94 s to 12.1 ks after the BAT trigger. The data comprise 221 s in Windowed Timing (WT) mode (the first 8 s were taken while Swift was slewing) with the remainder in Photon Counting (PC) mode. The enhanced XRT position for this burst was given by Goad *et al.* (GCN. Circ 14165).

The light curve (**Figure 2**) can be modelled with a power-law decay with a decay index of  $\alpha=1.09 \pm 0.06$ .

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of 2.22 (+0.31, -0.29). The best-fitting absorption column is  $3.9 (+1.2, -1.1) \times 10^{21} \text{ cm}^{-2}$ , in excess of the Galactic value of  $2.8 \times 10^{20} \text{ cm}^{-2}$  (Kalberla *et al.* 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is  $3.9 \times 10^{-11}$  ( $7.6 \times 10^{-11}$ )  $\text{erg cm}^{-2} \text{ count}^{-1}$ .

A summary of the PC-mode spectrum is thus:

Total column:  $3.9 (+1.2, -1.1) \times 10^{21} \text{ cm}^{-2}$

Galactic foreground:  $2.8 \times 10^{20} \text{ cm}^{-2}$

Excess significance:  $5.5 \sigma$

Photon index: 2.22 (+0.31, -0.29)

The results of the XRT team automatic analysis are available at [http://www.swift.ac.uk/xrt\\_products/00547420](http://www.swift.ac.uk/xrt_products/00547420).

## 4. UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 130131B 114 s after the BAT trigger (Siegel GCN Circ. 14169). No optical afterglow consistent with the XRT position is detected in the initial UVOT exposures. **Table 3** gives preliminary magnitudes using the UVOT photometric system (Breeveld *et al.* 2011, AIP Conf. Proc., 1358, 373). No correction has been made for the expected extinction in the Milky Way corresponding to a reddening of  $E_{B-V}$  of 0.03 mag. in the direction of the GRB (Schlegel *et al.* 1998).

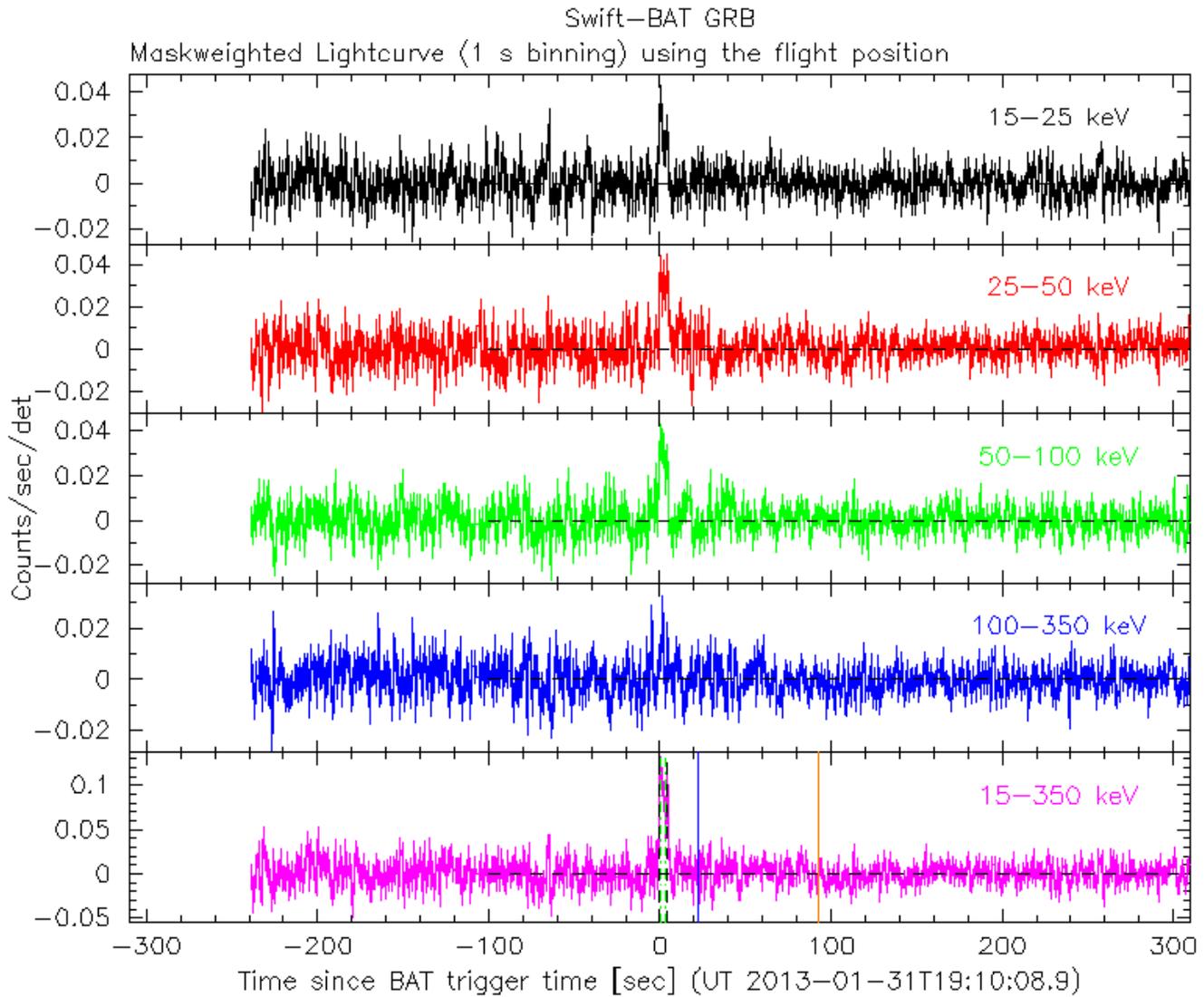


Figure 1. The BAT mask-weighted light curve in the four individual and total energy bands. The units are counts  $s^{-1}$  illuminated-detector $^{-1}$ .

## Swift/XRT data of GRB 130131B

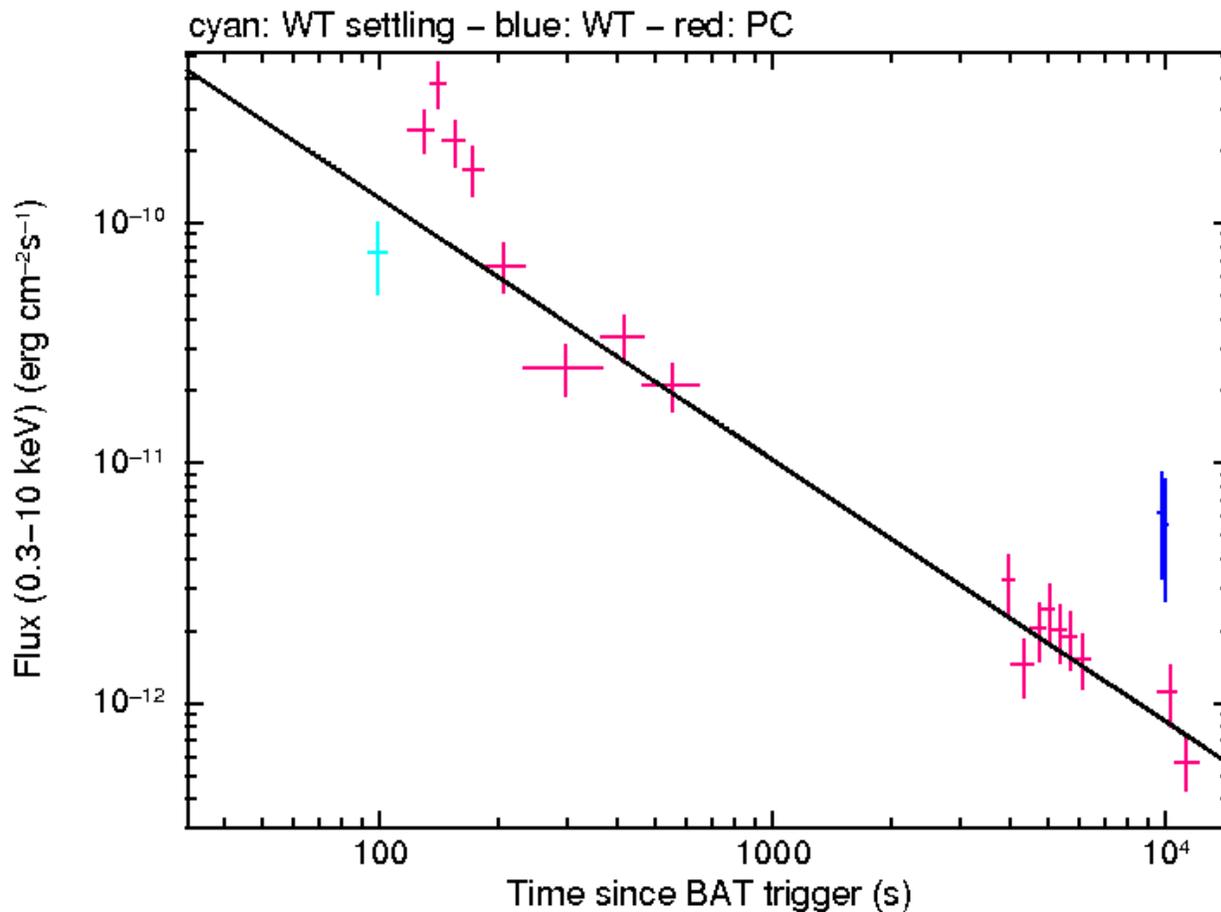


Figure 2. The XRT light curve.

RA	Dec	Error	Note	Reference
11 <sup>h</sup> 35 <sup>m</sup> 49.36 <sup>s</sup>	+15°02' 17.5"	1.8"	XRT-enhanced	Goad <i>et al.</i> GCN Circ. 14165
11 <sup>h</sup> 35 <sup>m</sup> 49.6 <sup>s</sup>	+15°01' 59.3"	1.7'	BAT-refined	Sakamoto <i>et al.</i> GCN Circ. 14164

Table 1. Positions from the Swift instruments.

Band	Authors	GCN Circ.	Observatory	Notes
Optical	Klotz <i>et al.</i>	14161	Zadko	
Optical	Klotz <i>et al.</i>	14162	TAROT	
Optical	Kuroda <i>et al.</i>	14167	MITSuME Okayama	upper limits
Optical	Gorosabel <i>et al.</i>	14170	IAC80	
Optical	Knust <i>et al.</i>	14173	GROND	upper limits
Optical	Schulze <i>et al.</i>	14174	VLT	upper limits
Optical	Butler <i>et al.</i>	14179	RATIR	upper limits

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Table 2. Summary of GCN Circulars from other observatories sorted by band and then circular number.

<b>Filter</b>	<b>T<sub>start</sub>(s)</b>	<b>T<sub>stop</sub>(s)</b>	<b>Exp(s)</b>	<b>Mag</b>
white <sub>FC</sub>	114	264	147	>20.9
u <sub>FC</sub>	327	577	246	>20.2
white	114	6416	449	>22.0
v	3871	5506	393	>19.8
b	583	6325	413	>20.5
u	327	6120	639	>21.0
w1	4281	5915	393	>20.4
m2	4076	5710	393	>20.6
w2	5101	5301	197	>21.1

Table 3. UVOT Observations. The start and stop times of the exposures are given in seconds since the BAT trigger. The preliminary 3- $\sigma$  upper limits are given. No correction has been made for extinction in the Milky Way.

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